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A Retrospective Survey and Assessment of Farmers Indigenous Knowledge on Anthrax in and Around Tanqua-Abergelle District, Northern Ethiopia

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Abstract: A Retrospective affiliation study has been conducted in Tanqua-abergelle district, central Tigray with the objectives of investigating the epidemiological position of anthrax in cattle, its public health importance and assesses farmers' indigenous knowledge on the disease. Secondary data and semi-structured questionnaire survey were the methods employed to study the exact position of the disease and asses the people′s awareness level about the disease in the area. Retrospective data results have indicated that a total of 504 anthrax cases were registered in cattle in the veterinary clinics and 2,680 human anthrax cases were recorded in the human hospital/clinics from the year 2008 to 2012. Agro-ecologically, 72.0% and 65.2% of the cattle and human anthrax cases, respectively, were originated from lowland areas of the district. Seasonally speaking, the disease was observed to commonly occur in the spring (52%) than the rest seasons indicating the significance of the hot environment in the spring and lowland area for the formation of *Bacillus* spores and its proliferation. The number of anthrax cases in cattle was decreasing from 39.1% in the year 2008 to 6.7% in 2012 indicating a relatively better level of awareness of the people and the effect of the four fold increase in livestock vaccination programs recorded across the retrospective years. Questionnaire survey results have further indicated that majority of the community members (97.5%) were aware of the nature, occurrence, public health importance and managements of the disease. However, the poor economic backgrounds together with the dispersed settlement nature of the farmers were the main identified gaps that have continued to force them consume positive moribund animals, sell their products and rely on uncertified traditional medicines that demand a future focus.

Key words: Anthrax · Cattle · Tanqua-Abergelle · Questionnaire Survey · Retrospective Study

INTRODUCTION

Anthrax is a fatal zoonotic disease caused by a rod-shaped, Gram-positive, aerobic spore forming non-motile bacteria called *Bacillus anthracis* (*B. anthracis*) [1-3]. The disease is characterized by septicaemia and sudden death with exudation of tarry blood from the body orifices of the cadaver. Failure of the blood to clot, the absence of rigor mortis and the presence of splenomegaly are the most important necropsy findings of the disease [4]. It is primarily a disease of herbivores although few, if any, warm blooded species are entirely immune to the disease. From earliest historical records until the development of an effective veterinary vaccine together with the subsequent advent of antibiotics, the disease was one of the foremost causes of uncontrolled mortality in cattle, sheep, goats, horses and pigs worldwide [1, 4]. Humans almost invariably contract anthrax directly or indirectly from animals. The disease is still enzootic in many countries of Africa, Asia, parts of Eastern Europe, the American continent and Australia [5].

Clinically, animal anthrax occurs in at least three different forms: the per-acute, acute and the sub-acute forms. Ruminants are most likely to manifest the per-acute and acute forms, horse the acute form and dogs, cats and pigs sub-acute to chronic or localized condition. In the per-acute disease, signs preceding death often go unobserved. Clinical anamnesis usually describes that the animal was in good health a few hours before death. If the animal is observed shortly before death, fever up to 42 °C,

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muscle tremors, dyspnoea and mucosal congestion are the most common signs. Shortly afterwards, the animal will often have terminal convulsions, collapse and then die. Following death, unclotted blood may sometimes be seen to exude from the natural orifices [1, 4 and 5].

Infection in humans traditionally has been much rarer than infection in animals. Anthrax occurred in people who come in contact with infected animals or animal products. It was frequently reported as an occupational disease, affecting veterinarians, people who raised livestock and people who prepared products from wool, hide and hair of animals mainly in the underdeveloped countries [1, 6]. There are three possible forms of the disease occurring in humans. The most common form has been reported to be cutaneous anthrax, in which the organism enters through a break in the skin and often begins as a papule at the entry site that progress over several days to a vesicle and then ulcerates. A more serious form is the inhalation anthrax with a mortality rate of up to 100%. Initial symptoms are vague and flu-like, progressing to hypotension, shock and massive bacteraemia and toxaemia [1]. Animal products such as processed wool, goat hair and handicrafts containing animal hides have been reported as a repeated source of infection of human beings [7]. The third form, intestinal anthrax, is contracted from the consumption of contaminated meat [1].

Anthrax is distributed worldwide, but is more common in the tropical than temperate areas. This is due to the high control measures in the developed temperate countries and, characteristically, due to the fact that anthrax *Bacillus* spores cannot be formed in cooler environments. The disease has so far been commonly reported in different parts of Ethiopia [6, 8-11]. Anthrax outbreak comes as an emergency unit for Ethiopia (EUE) who warned that a food crisis is looming parts of Ethiopia [12]. Although anthrax has become a progressive important disease in the country, its distribution and public health importance is not adequately studied to date.

In the study area, anthrax is regionally documented to be a major problem of animals and humans. To our knowledge, there are no works done so far that gathers and documents clinical case records on the disease and assesses the public awareness state on the disease. Hence, gathering of information on the disease and its nature of occurrence is an essential tool for future studies and in designing most reliable strategies for prevention and control of the disease in the study area in particular and the country in general. This study was, therefore, carried out to determine the exact position of anthrax and assess the status of the public´s indigenous knowledge on the disease in and around Tanqua-abergelle district.

MATERIALS AND METHODS

Description of the Study Area: The area receives a bimodal type of rainfall with the short rainy season, locally known as '*Tsidia*', often runs from June to August. The mean annual temperature ranges from 28 to 40 °C [13].

The total human population of the study area is 105,957 with a total of 54,022 households. Majority of the people often live in a scattered settlement manner within the area considering the availability of grazing lands for their domestic animals, the availability of arable lands and water sources in the surrounding. Besides, agro-pastoral type of production system is the more practical form of production in the study area. There are limited numbers of livestock population in the study area due to scarcity of forage production, especially during the dry season (Table 1) [13].

Study Methodology: A retrospective type of study was designed in the current study for collecting of previously recorded secondary data about anthrax in cattle and humans in the study area. Furthermore, a cross-sectional survey on the disease was carried out using prepared semi-structured questionnaires.

Secondary Data Collection: Secondary retrospective data were collected on the occurrence of anthrax outbreaks based on the obtained case records from the year 2008 to 2012 in Tanqua-abergelle district. For this, the veterinary clinics and the human hospitals/clinics case book records in the district as well as records in the Bureau of Agriculture and Rural Development (BARD) of the region were the important sources of data for the current study.

Questionnaire Survey: Semi-structured questionnaires were forwarded, randomly to a total of eighty respondents from group of farmers (mainly), professionals (veterinarians, veterinary clinicians, animal science experts and human health experts) and some animal owners/clients who came to the veterinary clinic of the district. Questionnaires were generally aimed so as to collect information concerning the occurrence of anthrax in the study area and on the various risk factors that are associated with the outbreaks of the disease.

Table 1: Livestock population of Tanqua-abergelle district

Animal species	Total number	Animal species	Total number
Cattle	75,546	Camel	325
Goat	100,027	Chicken	154,245
Sheep	62,138	Canine	13,583
Donkey	19,541	Feline	8,710
Horse	42	Bee hives	12,560
Mule	349		

Personal Observations: Due to the six years working experience shared by the author in the district´s veterinary clinic as an expert veterinarian, personal observations on the occurrence and general conditions of the disease were also incorporated as important inputs for the current study.

Data Management and Analysis: The data that was collected by using the questionnaires were entered and stored into a Microsoft Ex-cell and descriptive statistics (frequencies, percentages and means values) were further calculated. Furthermore, data were summarized using frequency tables.

RESULTS

The present survey was conducted in order to gather previous and recent information and asses the people′s attitude and practice about anthrax in the study site, Tanqua-abergelle and its surrounding peasant associations. Semi-structured questionnaires were distributed among selective people and existing retrospective data were further gathered from responsible offices in the area and assessed accordingly.

Results of Retrospective Data:

Anthrax Cases in Cattle: A retrospective data of five years, from 2008 to 2012, on the disease anthrax were collected from respective concerned offices in the study area. As a result, a total of 504 symptomatic and confirmatory cases of anthrax have been registered in cattle in the district′s diagnostic veterinary clinics, out of which 197 cases (39.1%) were observed in 2008, 123 (24.4%) in 2009, 86 (17.1%) in 2010, 64 (12.7%) in 2011 and the least record being for the year 2012 as 34 (6.7%) cases. Results of retrospective data have indicated that there was an annual decreasing record of anthrax cases in the study area (Table 2).

The seasonal outbreaks and the agro-climatic states of the different peasant associations in the study area were also assessed in relation to the occurrence of the disease. Accordingly, out of the total cases recorded, 262 (52.0%) had occurred in the spring, 118 (23.4%) in autumn, 69 (13.7%) in winter and 55 cases (10.9%) were recorded in the summer seasons. Results obtained have, thus, indicated that a highest record of anthrax outbreaks occurred in the spring seasons of the stated years (Table 3). Furthermore, with regard to the agro-climatic distribution of the disease, about 72% (363/504) of the cases were seen in the lowland and the rest 28% (141/504) in the midland areas of the study sites (Table 4).

Anthrax Cases in Humans: A five year recorded data (2008 to 2012) of human anthrax cases were collected from the human hospital and/or clinics in the study area. Accordingly, a total of 2,680 human anthrax cases were registered across the five years period. Furthermore, out of the totally recorded human anthrax cases, 1,748 (65.2%) were seen in the lowland area and the rest 932 cases (34.8%) were recorded in the midland dwellers of the district area (Table 4).

Results of Questionnaire Survey: Semi-structured questionnaires were randomly forwarded to a total of eighty individuals composed of household farmers (92%) and animal owners/clients (8%) who came to the veterinary clinic for medication during the data collection period. As a result, enormous information that are related to the occurrence of anthrax and the different risk factors that are associated with the outbreak of the disease were collected and analyzed.

Indigenous Knowledge of Respondents about Anthrax: The assessed questionnaire results were with an almost 100% respondent rate and have indicated that farmers were, generally, found to be aware of several points concerning anthrax. This, in turn can be related to the observed decreasing occurrence of the disease outbreak cases across the years 2008 to 2012 (Table 2). All of the interviewed respondents (100%) have stated that they know and have ever heard about the disease anthrax and almost all of them (98.6%) have mentioned that all age groups and both sexes of humans and animals can possibly be infected with the disease. Considering the source of infection, 92% of the respondents have stated that the primary source of infection to animals is the contacts made with the dead carcass of animals with cases of anthrax.

Respondents were also asked about any of the clinical signs they know or have ever appreciated related to anthrax. As a result, 82.4% of them have mentioned some related signs to the disease including: in appetence,

Table 2: Retrospective anthrax outbreak cases recorded in cattle of the study area (2008-2012)

Year	Number of outbreaks	Percentage (%)
2008	197	39.1
2009	123	24.4
2010	86	17.1
2011	64	12.7
2012	34	6.7

Table 3: Seasonal occurrence of anthrax outbreak cases in cattle of the study area (2008-2012)

	Autumn		Summer		Spring		Winter	
Year	No.	%	No.	%	No.	%	No.	%
2008 (n= 197)	41	20.8	26	13.2	103	52.3	27	13.7
2009 (n= 123)	31	25.3	11	8.9	62	50.4	19	15.4
2010 (n= 86)	23	26.7	8	9.3	46	53.5	9	10.5
2011 (n= 64)	14	21.9	5	7.8	37	57.8	8	12.5
2012 (n= 34)	9	26.5	5	14.7	14	41.2	6	17.6
Total (n= 504)	118	23.4	55	10.9	262	52.0	69	13.7

Table 4: Agro-climatic distribution of human and cattle anthrax outbreak cases in the study area (2008-2012)

	Number of outbreaks		Prevalence (%)	
Agro-climatic zones	Cattle	Humans	Cattle	Humans
Lowland area	363	1748	72	65.2
Midland area	141	932	28	34.8

Table 5: Livestock vaccination records against anthrax inTanqua-abergelle district (2008-2012)

Year	Number of vaccinated animals
2008	13,200
2009	16,900
2010	36,575
2011	41,000
2012	59,125

Source: (BARD, 2013)

dyspnoea, depression, erection of hair and congestion of the visible mucus membranes prior to their death and bleeding natural orifices soon after their death. Indeed, 39 respondents (48.8%) have mentioned that they have received educational services from health professionals in the study area in clarification to the source of information they provided about anthrax.

Furthermore, in reply to the seasonal occurrence of anthrax, 56 (70%) of the respondents indicated that anthrax outbreaks were occurring during the spring seasons, 10 (12.5%) said during summer, 8 (10.0%) during winter; whereas 6 (7.5%) of them have answered that outbreaks of the disease are erratic and follows no seasonal pattern. Whereas magnitudnally speaking, 85.1% of the respondents answered that the disease is widespread and the rest 14.9 % have mentioned that the disease is intermittent (sporadic) in its distribution in the study area.

Attitude and Practices of Respondents about Anthrax: 78 respondents (97.5%) have attested that anthrax is a zoonotic disease and, hence, can be transmitted from animals/cattle to humans, with 95.0% of them stating that humans can acquire the disease from the consumption of infected carcass and further 5.0% of the respondents have additionally mentioned that humans can also acquire the disease through contacts made with infected animals during treatment measures, animal handling and feed offer. Respondents were further asked on their attitude whether anthrax can be treated and/or prevented, or not. Accordingly, 48 respondents (60%) have mentioned that the disease can easily be treated with antibiotics in its early stages while 65 respondents (81.2%) have mentioned that the disease can be prevented through routine vaccination programs. Due to the fact that farmers were aware about the severity of the disease and the need for vaccination of their livestock against such a disease, an increasing record of livestock vaccination programs against anthrax were observed across the years of the retrospective data assessment, 2008-2012 (Table 5). Furthermore, 11 respondents (13.8%) have mentioned that the prevention of anthrax is also possible through traditional treatment measures and the remaining (5.0%) have mentioned both preventive measures.

Respondents were also asked about the immediate and/or gradual measures or practices they took or they have to take when they encounter a symptomatic case of anthrax, or when their animal was found to be symptomatically positive for anthrax. Accordingly, 83.7% of the respondents have answered that they immediately took the diseased animal to the nearby veterinary clinics, 3.8% answered that they destroyed the animal and the rest 10 respondents (12.5%) have stated that they slaughter the animal for human consumption and sale of its skin. With regard to the general management aspects they took during outbreaks in their surroundings, 13.7% of the respondents answered that they managed their animals by isolating or preventing contact with other animals in their vicinity.

DISCUSSION

Anthrax is a zoonotic disease of public and economic importance which is found worldwide in distribution [1, 6]. In this study an attempt was made to assess the epidemiological distribution and public health importance of anthrax and the public´s knowledge on the disease in Tanqua-abergelle district and its surrounding peasant associations.

Retrospective Data: Anthrax was found to be highly prevalent in cattle of the study area although a decreasing outbreak cases were observed from year to year. Furthermore, the cases of anthrax were seen to occur more commonly in the spring season (52%) than the other seasons. This is possibly due to the fact that this season is often hot (> 20 °C) and the condition is favourable for spore formation, hence, it is likely true that anthrax can relatively occur at higher rate in the spring seasons. These results are in agreement with reports of Radostits *et al*. [1] and Coherence and Fraser [14] who stated that animals become readily infected with anthrax, when the minimum daily temperature is above 15°C.

Regarding the agro-climatic distribution of anthrax, the present study revealed that cases were more commonly recorded in the lowland areas (72%) than the midland areas (28%) of the study site. These results indicate that the causative bacteria, *B. anthracis*, needs hot environment for the formation of spores and its proliferation. Similarly, Radostits *et al.* [1], Hall, [15] and Devrim *et al*. [16] stated that the spores of *B. anthracis* are not readily formed in cooler environments and cannot be formed or become infective at above 250 meters altitude.

According to Radostits *et al*. [1] and Fekadu *et al*. [8], outbreaks of anthrax are commonly seen in natural, alkaline calcareous soil type that can serve as incubator media for *B. anthracis* to stay longer and cause further outbreak after a long period of time when conditions are favourable for its proliferation. In line with these findings, obtained data for results of the current study have also revealed that the soil type of the study area is alkaline in its nature with salty water and some dispersed rocky plains strongly supporting the likelihood for the prevalence of the disease in the study area.

Recorded cases of cattle anthrax, from 2008 to 2012, in the study area were observed to decrease from 39.1% in 2008 to 6.7% in 2012. This might be due to the increasing livestock vaccination records seen across these years (4 fold increase) and a relatively better level of awareness and attitude of farmers about the disease was observed from respondents. Likewise, FAO, [17] and Smith, [18] have reported that because anthrax is often fatal in domestic animals, preventive strategies involving vaccination of animals, dead animal burial and not opening the body of a recently died animal as exposure to air of infected tissue can stimulate sporulation and proper disposal of the carcass by burial or burning to prevent contamination of the environment are the most top important criteria in reducing the incidence of anthrax in a given outbreak area. Similarly, Fekadu *et al*. [8] have also recommended the same points so as to reduce outbreaks of anthrax in some of the endemic wildlife resources of Ethiopia.

Questionnaire Survey: Results of the questionnaire survey have, generally, indicated the true prevalence of the disease in the study area and that farmers are well aware of the disease features including the susceptibility of animals and humans to the disease, the early and moribund stage signs of the disease, the seasonal outbreak periods, the role of vaccination and effectiveness of treatment in early cases, the zoonotic importance of the disease and the possible transmission routes to humans. Likewise, Urgessa *et al.* [19], Asrat *et al.* [20] and Moges and Bogale [21] have also stated that 4.4, 16.8 and 20.65% of their respondents have confirmed anthrax as the major health problem in animals and humans in different parts of the country, Ethiopia.

Despite the people have indicated that anthrax can infect humans and the main sources of infection to humans were consumption of dead or moribund carcass and infective blood during slaying (95%), some people still continue to consume the carcass of animals with anthrax (12.5%). This might be due to the poor economic background of these farmers that they could not afford the cost of an ox or a cow lost from the disease. Hence, they prefer to slaughter the animal, redistribute the meat to neighbouring people with lower price and further sell the skin on market to compensate the cost of the lost animal. It is also generally true and undeniable that most of the rural communities of Ethiopia have the habit of consuming recently died or moribund animals with the help of their neighbours during accidents and sudden deaths [8, 10]. In agreement with this finding, regarding the source of anthrax to humans, Radostits *et al*. [1], Mekonnen *et al.* [9] and Hailemariam, [10] have also stated that it is well established that the carcass of animals, which have died of anthrax, are a prime source of infection to humans.

Even though majority of the interviewed respondents (83.7%) stated that they took their sick animals to the nearby veterinary clinics, it was also seen that some of the farmers in the study area entirely relayed in traditional medicines (13.75%). The possible reasons could, primarily, be due to the scattered population settlement nature in the study area [13], some farmers are distantly located at mountainous sites where access to nearby veterinary clinics is hardly possible; and, secondarily, due to the fact that farmers have also observed an effective response

from these medicaments in the relief of several animal diseases, including anthrax. In line with these findings, Gebrezgabiher *et al.* [22] have carried out an ethno-veterinary survey in the same area and its neighbour district, Kolla Tembien; and have reported a list of 29 effective medicinal plants that were used by the farmers in the treatment and management of livestock health problems in the vicinity.

CONCLUSION

Anthrax, a per-acute zoonotic disease, was found to be highly prevalent in both animals and humans in the study area, Tanqua-abergelle. Cattle and human anthrax cases were more commonly recorded in the lowland area than the midland area and in the spring seasons than in the rest seasons of the study years. Furthermore, respondent farmers were found to be in a better awareness level about the zoonotic nature and public health importance of anthrax.

Hence, in light with these findings, a further knowledge transfer on the overall nature and severity of the disease is highly important to be addressed to farmers of the district. The importance of scheduled livestock annual vaccination programs need to be further emphasised, often to be carried out 2-4 weeks before the onset of a known period of an outbreak. Governmental and non-governmental organizations should search for alternatives that will strengthen the economic background of farmers and address the veterinary services accessible to all concerned sites in the district for earlier treatments and better disposal means of dead animals.

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